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The Impact of Non-Performing Loans on Bank Growth: The Moderating Roles of Bank Size and Capital Adequacy Ratio—Evidence from U.S. Banks

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Abstract

Banks in the United States face persistent challenges from non-performing loans (NPLs), despite conducting thorough client evaluations before issuing loans. To mitigate the impact of NPLs and support both local and global growth, banks must adopt effective risk management strategies. This study investigates the effect of NPLs on bank growth and the moderating of bank size and Capital Adequacy Ratio (CAR) through the lens of the Resource-Based View (RBV) theory. A sample of 253 banks listed on the New York Stock Exchange from 2006 to 2023 was selected using specific inclusion criteria from the Thomson Reuters Eikon DataStream. To address cross-sectional dependence and endogeneity, advanced estimation techniques—Feasible Generalized Least Squares (FGLS), Driscoll and Kraay standard errors, and the Generalized Method of Moments (GMM)—were employed. The results show that NPLs have a significant negative impact on banks' asset and income growth. Furthermore, bank size and capital adequacy ratio (CAR) negatively and significantly moderate this relationship. These findings underscore the need for banks to enhance credit risk management by strengthening loan approval processes and leveraging advanced analytics to assess borrower risk more accurately.

Keywords: asset growth; banks; income growth; non-performing loans; Resource-Based View (RBV) theory

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1. Introduction

A loan is classified as a non-performing loan (NPL) when the borrower fails to make payments for a specified period, typically 90 days or more (Asfaw et al., 2016). NPLs arise from delayed or missed payments on loan interest or principal. These loans cease to generate income and diminish bank profitability, posing significant risks (Singh et al., 2021). Banks must allocate additional resources for bad debt provisions, diverting capital from investment and growth opportunities (Agrawal & Magar, 2023). High NPL levels can impair liquidity, forcing banks to seek alternative funding or retain more earnings to maintain capital adequacy. A sustained rise in NPLs can restrict a bank's lending capacity and expansion, leading to long-term operational and financial challenges (Lehmann, 2021).

Sustained growth is vital for a bank's success, enabling it to expand its client base, revenue, and market presence (Attah et al., 2024). Growth also allows banks to achieve

economies of scale, reducing operational costs over time. In today's competitive global financial landscape, growth is essential for survival (Cho, 2024). Without it, banks become more vulnerable to economic shocks and competitive pressures. Moreover, growth supports investment in new technologies, adaptation to changing consumer needs, and innovation (Hlushenkova et al., 2024). Investors are more likely to support growing banks, while stagnant ones often struggle to attract capital.

NPLs significantly affect a bank's growth prospects. High NPLs restrict lending, deter investors, and limit banks' growth capacity by raising risks and diverting resources from innovation (Baudino & Yun, 2017; Boateng & Dean, 2020). They erode profitability and capital buffers, weakening competitiveness and sustainability (Thornton & Di Tommaso, 2021; Boubaker et al., 2024). Effective credit risk management is thus critical, as rising NPLs distort banking growth and stability (Abdou & Alarabi, 2024; Pasaribu & Mindosa, 2021).

Several studies have explored the impact of NPLs on banks' financial performance (Gabriel et al., 2019; Al Zaidanin & Al Zaidanin, 2021). Some have also examined their effect on bank growth. For instance, Tölö and Virén (2021), using data from 200 banks across 30 European Economic Area countries, found that NPLs had a negative and significant impact on lending and loan growth. Gjeçi et al. (2023), analyzing data from 42 countries between 2000 and 2017, also reported a negative relationship between NPLs and bank loan growth. Similarly, Chun and Ardaaragchaa (2024), studying six Mongolian commercial banks, found that NPLs negatively influenced total loan growth.

These studies typically use loan growth as a proxy for bank growth. However, bank growth is multifaceted and can also be measured by asset and income growth (Rothaermel, 2019). The impact of NPLs on these broader indicators remains underexplored, creating a gap in both theory and empirical research. Additionally, the moderating effects of bank size and capital adequacy ratio (CAR) on the NPL-growth relationship are largely unexamined.

NPLs can severely hinder a bank's growth, reduce competitiveness, and stifle innovation (Scardovi, 2016). Recent evidence further shows that rising NPLs undermine stability and performance across different banking systems (Boubaker et al., 2024; Bhowmik & Sarker, 2024). Given the lack of research on the relationship between NPLs and asset/income growth, this study aims to address these gaps. Its findings may offer valuable insights for investors and banks in making strategic decisions to enhance financial performance. This study develops three interconnected research questions to explore how NPLs influence bank growth.

The first examines the direct effect of NPLs, underscoring how deteriorating asset quality constrains profitability and expansion. The second considers the moderating role of bank size, as larger banks may absorb credit shocks more effectively due to diversification and economies of scale. The third extends the analysis by assessing whether the CAR mitigates the adverse effects of NPLs, given its role in strengthening resilience against financial distress. Together, these questions move from the baseline impact of NPLs to the conditional effects of institutional characteristics. This progression provides a comprehensive perspective on how loan quality and internal bank attributes shape growth outcomes in the U.S. banking sector.

This study contributes to the literature by investigating how NPLs affect asset and income growth—offering a broader view of bank performance beyond conventional metrics like loan growth. These insights can inform strategies for improving institutional resilience and long-term stability.

Second, the study explores how bank size moderates the relationship between NPLs and growth. This is critical for understanding whether small and large banks experience different levels of vulnerability, thereby enabling more nuanced regulatory and strategic responses.

Third, it examines the moderating role of CAR, which reflects a bank's ability to absorb financial shocks. Understanding this dynamic helps determine whether well-capitalized banks can sustain growth amid rising NPL levels.

In light of growing credit risk exposure—especially in volatile economies—this study provides critical insights for policymakers, regulators, and bank executives. It highlights key internal and external factors influencing performance, guiding strategic planning, resource allocation, and efforts to enhance financial resilience. This is particularly relevant in emerging economies, where banking systems often face structural and economic challenges.

2. Literature Review

2.1. Theoretical Background of the Study

The Resource-Based View (RBV) provides a valuable theoretical framework for understanding the impact of non-performing loans (NPLs) on bank growth. It offers insights into how internal resources and stakeholder dynamics influence the management of NPLs and their broader implications for financial performance (Ozdemir et al., 2023).

With its focus on internal resources and capabilities, the RBV is well-suited for this study. According to the theory, a bank's ability to effectively utilize its financial assets, human capital, and technological capabilities is central to gaining a competitive advantage and achieving long-term growth (Ayub et al., 2017). NPLs can erode these resources, threatening a bank's operational and strategic viability. Thus, the RBV provides a strong foundation for examining how such disruptions affect institutional performance.

Efficient resource management is fundamental to sustained development, as emphasized by the RBV (Assensoh-Kodua, 2019). Rising loan loss provisions and declining capital reserves due to high NPL levels place significant strain on banks. These conditions highlight the importance of developing effective strategies to mitigate the adverse effects of NPLs. Through the RBV lens, banks are seen as capable of mobilizing internal assets—human, financial, and technological—to manage NPLs while maintaining or even enhancing growth (Gerhart & Feng, 2021).

The RBV also underscores the role of organizational competence and strategic management. Banks with superior internal capabilities such as advanced operational systems and robust risk management frameworks are better positioned to handle NPLs and sustain growth (Naili & Lahrichi, 2022). The practical application of RBV thus supports strategic responses, including enhancing operational efficiency and implementing comprehensive risk controls, to counteract the impact of NPLs.

A key concept within the RBV is dynamic capabilities—an organization's ability to reconfigure its resources and strategies in response to evolving conditions (Battisti & Deakins, 2017). In the context of NPLs, this refers to a bank's capacity to realign resource allocation and adjust strategic priorities in response to rising credit risk. This adaptability is critical to navigating financial challenges and maintaining growth. The RBV framework, therefore, offers essential insights into how banks can respond innovatively and strategically to NPL-related pressures.

By applying the RBV, this study contributes to understanding how banks can harness internal strengths to manage financial shocks. It also provides policymakers and practitioners with a framework to evaluate banks' resilience, adaptability, and capacity for innovation in the face of growing credit risk.

2.2. Hypothesis Development

2.2.1. The Influence of NPLs on Bank's Growth

NPLs undermine the quality and value of loan portfolios, negatively affecting bank asset growth (Ozili, 2019). A high proportion of NPLs forces banks to increase loan loss

provisions, reducing their ability to extend new credit and expand assets. Declining loan quality and rising credit risk further constrain asset growth (Naili & Lahrichi, 2022). Empirical evidence from Mileris (2015) shows that elevated NPL levels are linked to shrinking asset bases during financial crises. Similarly, Chryses (2020) found that banks with high NPL levels experienced reduced asset growth, as resources were diverted toward risk management and provisioning rather than investment or expansion.

High NPL levels can also threaten a bank's capital adequacy and solvency, discouraging asset expansion and new investments (Oino, 2021; Arhinful et al., 2025a). Regulatory constraints on capital buffers and asset quality impose stricter lending standards on banks with substantial NPLs, further limiting their growth potential. Nevertheless, this deterioration can encourage more conservative lending practices, which, if managed effectively, may lead to more sustainable and resilient banking operations (Bernanke, 2018). Zheng et al. (2019) found that banks burdened with high NPLs tend to reduce lending, directly constraining asset growth due to capital adequacy pressures and risk-averse behavior.

NPLs also hinder income growth by reducing interest income, a core component of bank revenue (Singh et al., 2021). Banks must stop accruing interest on non-performing loans, directly lowering their net interest income. This decline adversely affects profitability and long-term growth. Singh et al. (2021) further emphasized that banks with significant NPL burdens report weaker revenue performance and lower returns on assets due to reduced interest income and higher impairment charges, thus undermining financial stability.

Beyond interest income, NPLs increase operational and administrative costs related to debt recovery, legal proceedings, and asset management, placing additional pressure on income growth (Baudino & Yun, 2017). Banks also incur costs from loan restructuring and regulatory compliance. Research by Alnabulsi et al. (2023), found that rising NPLs significantly reduce bank profitability by increasing non-interest expenses and suppressing lending activity. These financial burdens limit banks' ability to reinvest profits, pay dividends, and remain competitive, ultimately slowing income growth. Based on the above, this study proposes the following hypothesis:

Hypothesis 1 (H1). *NPLs have a negative and significant impact on bank growth.*

2.2.2. The Moderating Role of Bank's Size in the Relationship Between NPLs and Bank's Growth

Bank size plays a significant role in shaping the relationship between NPLs and asset growth, potentially amplifying or alleviating adverse effects. Larger banks typically possess stronger capital buffers, diversified portfolios, and advanced risk management frameworks, allowing them to better absorb the impact of NPLs on asset growth (Y. T. Chang, 2006). Even amid increasing NPL levels, these institutions can maintain asset expansion and manage credit risk more efficiently. Beccalli et al. (2015) found that larger banks sustained asset growth during financial crises due to their economies of scale and diversification, providing enhanced stability and resilience.

In contrast, smaller banks often lack the financial strength and operational capacity to buffer against the effects of NPLs. These institutions may be forced to reduce lending and increase provisioning, directly impeding asset growth (Brik, 2024). Osei-Assibey and Asenso (2015) observed that smaller banks in developing economies experienced a more pronounced negative relationship between NPLs and asset growth, largely due to capital limitations and limited resource availability. This underlines the heightened vulnerability of smaller banks, particularly their inability to capitalize on economies of scale—cost advantages enjoyed by larger institutions due to greater output and operational capacity.

Bank size also influences the relationship between NPLs and income growth. Larger banks are generally more capable of managing income volatility resulting from NPLs,

owing to diversified income sources such as fees, trading, and international operations (DeYoung & Rice, 2004). This income diversification acts as a buffer against losses in interest income, enabling large banks to sustain income growth despite rising NPLs. Arnone et al. (2024) affirmed that larger banks demonstrated greater income resilience during periods of elevated NPLs due to the stability of their revenue streams.

Conversely, smaller banks tend to depend heavily on interest income, making them more susceptible to the adverse financial effects of NPLs (Nkusu, 2011). Rising NPLs reduce their profitability, as these institutions have limited avenues for generating non-interest income or offsetting credit losses. Cope and Carrivick (2013) found that smaller banks incurred greater income losses during financial crises, in part due to their constrained capacity to manage the financial stress caused by NPLs. Based on these discussions, this study proposes the following hypothesis:

Hypothesis 2 (H2). *Bank size negatively and significantly moderates the relationship between NPLs and bank growth.*

2.2.3. The Moderating Role of CAR in the Relationship Between NPLs and Bank's Growth

The CAR plays a critical role in risk management by balancing asset growth with the risk posed by non-performing loans (NPLs). Banks with high CARs exhibit strong resilience to losses from deteriorating asset quality, enabling them to sustain asset expansion even amid rising NPLs (Velliscig et al., 2022). A robust CAR signals solvency to regulators and investors and enhances a bank's capacity to maintain lending and investment activities. Olawale (2024) observed that well-capitalized banks continued to grow their assets despite increased credit risk, emphasizing the importance of CAR in preserving stability.

When NPLs rise, banks with low CARs risk breaching regulatory requirements and may be compelled to reduce risk-weighted assets (Masera, 2019). This constrains their ability to fund new projects or expand lending portfolios, leading to more conservative strategies that hinder asset growth. Atici and Gursoy (2011) reported that banks with inadequate capital buffers experienced significant declines in asset growth during the financial crisis due to reduced lending and increased provisioning for NPLs.

CAR also influences how NPLs affect income growth. Well-capitalized banks are better positioned to absorb loan losses without severely compromising profitability, allowing them to continue revenue-generating activities, such as lending and providing financial services (Saadaoui & Mokdadi, 2023). Akhalumeh (2011) found that such banks maintained income stability more effectively during financial downturns than undercapitalized institutions.

In contrast, banks with weak CARs often reduce lending and allocate more resources to cover losses, limiting their profitability (Cade, 2013). Efforts to rebuild capital levels can lead to stricter lending standards and operational cutbacks, further constraining income growth. Singh et al. (2021) noted that insufficient capital intensified profitability declines, as financial stress impaired income generation amid rising NPLs. Based on these insights, the study proposes the following hypothesis:

Hypothesis 3 (H3). *CAR negatively and significantly moderates the relationship between NPLs and bank growth.*

3. Results and Discussion

3.1. Descriptive Analysis

Table 1 presents the descriptive statistics of the variables used in this study. The average asset growth indicates positive expansion of the banks' asset base, reflecting their ability to mobilize resources and engage in financial intermediation. This is essential for

ensuring stability and promoting sustainable development in the financial sector. The average income growth suggests that banks are consistently generating revenue, demonstrating operational profitability and financial stability, which are critical for reinvestment, risk management, and maintaining regulatory and shareholder confidence.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max	VIF	1/VIF
Asset growth	4301	6.955	9.981	−83.86	75.8	-	-
Income growth	4301	6.643	7.357	−4.506	19.894	-	-
NPLs	4301	5.384	0.904	3.003	17.888	2.939	0.34
Changes in inflation	4301	2.477	1.885	−0.356	8.003	1.06	0.943
Bank size	4301	6.554	0.731	5.069	9.588	2.973	0.336
ROA	4301	7.372	9.842	−34.984	23.973	1.084	0.923
CAR	4301	13.261	4.105	0.269	47.523	1.173	0.853

The average level of NPLs indicates a moderate degree of credit risk within the banking system. This could potentially threaten financial performance, requiring enhanced risk assessment, loan monitoring, and credit recovery strategies to safeguard asset and income growth. The average changes in inflation suggest a stable macroeconomic environment, supporting uniform lending and investment decisions. However, persistent inflation may undermine real returns, borrowing capacity, and the performance of long-term credit portfolios.

The average bank size reveals that the institutions in the sample are relatively large, with access to diverse funding sources and the ability to operate in broader markets. This enhances their capacity to expand, absorb losses, and invest in technology and customer service improvements. The average ROA demonstrates that banks are effectively leveraging their assets to generate profits, ensuring operational sustainability and long-term financial viability, which are essential for investments and competitiveness within the sector. The average CAR reflects a strong capital buffer that enables banks to comply with regulatory requirements and withstand potential losses, further supporting their ability to facilitate credit expansion and stability, and enhancing confidence among depositors and investors.

To assess multicollinearity among the independent variables, the Variance Inflation Factor (VIF) was calculated. Multicollinearity can distort model estimates, inflating standard errors and making it difficult to identify the effects of individual variables. In this study, none of the VIF values exceeded 5 (Mensah & Bein, 2023; Arhinful et al., 2025c), indicating the absence of significant multicollinearity. This ensures that each variable contributes independently to explaining variations in the dependent variable, thereby improving the reliability of the regression results.

3.2. Matrix Correlation Analysis

The study used matrix correlation analysis, as shown in Table 2, to assess the degree of multicollinearity among the independent variables. The goal was to determine whether any significant correlation existed between two independent variables, which would violate the assumption of predictor independence required by Ordinary Least Squares (OLS). Multicollinearity is indicated when the correlation coefficient exceeds 0.70 (Obeng et al., 2025; Arhinful et al., 2023b). This study found no evidence of multicollinearity, as the correlation coefficients between the independent variables remained below 0.70. Therefore, the lack of significant correlations ensures the reliability of the regression results and the validity of the OLS estimations. The VIF results presented in Table 1 further confirm these findings.

Table 2. Matrix of correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Asset growth	1.000						
(2) Income growth	0.005	1.000					
(3) NPLs	−0.023	−0.024	1.000				
(4) Changes in inflation	−0.059	0.014	−0.035	1.000			
(5) Bank size	0.068	−0.015	−0.080	0.113	1.000		
(6) ROA	0.023	0.003	−0.047	0.104	−0.072	1.000	
(7) CAR	0.265	0.008	−0.218	0.184	0.503	−0.502	1.000

3.3. Panel Unit Root Analysis

This study employed the Cross-sectional Augmented Dickey–Fuller (CADF) and Cross-sectional Augmented IPS (CIPS) tests for unit root analysis, as the panel data exhibited cross-sectional dependence, as shown in Table 3. Cross-sectional dependence, caused by correlations in panel error terms, can distort the results of traditional panel unit root tests. To address this, the CADF and CIPS tests were used to provide more reliable and accurate findings in the presence of cross-sectional dependence.

Table 3. Unit root tests.

Variable	Cross Sectional Augmented Dickey–Fuller (CADF) Test		Cross-Sectional Augmented IPS (CIPS)	
	Levels	1st Difference	Levels	1st Difference
Asset growth	−45.508 (0.000) ***	−79.524 (0.000) ***	−43.730 (0.000) ***	−78.481 (0.000) ***
Income growth	−39.521 (0.000) ***	−78.240 (0.000) ***	−36.550 (0.000) ***	−77.274 (0.000) ***
NPLs	−50.991 (0.000) ***	−87.895 (0.000) ***	−50.453 (0.000) ***	−89.196 (0.000) ***
Changes in inflation	−33.456 (0.000) ***	−57.234 (0.000) ***	−38.973 (0.000) ***	−68.343 (0.000) ***
Bank size	−49.390 (0.000) ***	−87.316 (0.000) ***	−48.443 (0.000) ***	−89.574 (0.000) ***
ROA	−7.345 (0.000) ***	−28.536 (0.000) ***	−8.034 (0.000) ***	−28.663 (0.000) ***
CAR	−4.782 (0.000) ***	−15.734 (0.000) ***	−5.682 (0.000) ***	−18.934 (0.000) ***

*** $p < 0.01$.

The null hypothesis for these tests posits that the panel data has a unit root, indicating non-stationarity and stochastic behavior. In contrast, the alternative hypothesis suggests that the data is stationary and exhibits mean reversion, indicating no unit root. The tests were conducted at both levels and first differences. The results showed that the variables were stationary at both levels and first differences, indicating they are integrated of order zero (I(0)). Since the series are stationary and do not require further differentiation, the data is deemed suitable for subsequent analysis and model estimation.

3.4. Testing of Hypothesis

Table 4 presents the results of FGLS, showing the impact of NPLs on a bank's growth. The hypothesis testing of this study was based on this result.

Table 4. Feasible generalized least squares regression.

	Asset Growth			Income Growth		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
NPLs	−0.280 ***	−0.510 ***	−0.582 ***	−0.271 ***	−0.026 ***	−0.304 ***
	(0.028)	(0.100)	(0.233)	(0.113)	(0.002)	(0.044)

Table 4. *Cont.*

	Asset Growth			Income Growth		
Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Changes in inflation	−0.526 *** (0.082)	−0.571 *** (0.081)	−0.579 *** (0.080)	0.048 *** (0.011)	0.046 *** (0.012)	0.050 *** (0.011)
Bank size	0.386 *** (0.035)	0.106 *** (0.009)	0.473 *** (0.103)	0.065 *** (0.022)	0.240 *** (0.067)	0.394 *** (0.118)
ROA	0.074 *** (0.028)	0.077 *** (0.022)	0.085 *** (0.031)	0.864 *** (0.332)	0.873 *** (0.309)	0.888 *** (0.322)
CAR	0.534 *** (0.205)	0.578 *** (0.212)	0.683 *** (0.228)	0.093 *** (0.004)	0.095 *** (0.005)	0.098 *** (0.005)
NPLs × Bank's size		−0.124 *** (0.015)			−0.032 *** (0.004)	
NPLs × CAR			−0.434 *** (0.083)			−0.678 *** (0.053)
Constant	4.797 *** (1.477)	4.498 *** (1.401)	4.473 *** (1.421)	7.114 *** (1.106)	6.008 *** (2.075)	7.834 *** (1.173)
Number of observations	4301	4301	4301	4301	4301	4301
Chi-square	137.507 (0.000)	207.130 (0.000)	207.132 *** (0.000)	3.207 (0.000)	3.287 (0.000)	3.382 (0.000)

*** $p < 0.01$.

The study found that NPL had a negative and significant influence on banks' growth (Asset and income growth). These findings aligned with Hypothesis H1. Therefore, it was supported and confirmed.

The study revealed that the moderating role of bank size and CAR in the relationship with NPLs had a negative and significant impact on a bank's growth (Assets and income growth). These findings support Hypotheses H2 and H3, which were accepted and confirmed.

3.5. Robustness Testing

The robustness test in this study, essential for ensuring the consistency and reliability of the findings, was conducted using the Driscoll and Kraay standard errors model. This model was specifically employed to validate the robustness of the FGLS estimation results, particularly in the presence of cross-sectional dependence. The Driscoll and Kraay estimator is well-suited for panel data models with cross-sectional dependence, effectively addressing heteroscedasticity and autocorrelation (Arhinful et al., 2025c; Mensah et al., 2025). Its use ensures that the estimated coefficients remain unbiased, despite complex correlation patterns, thus preserving the fairness of the methodology.

The Driscoll and Kraay estimation results presented in Table 5 confirm the findings from the FGLS model, further validating the robustness of this study's conclusions. This robustness test significantly strengthens confidence in the study's results, establishing a reliable foundation for their applicability to broader contexts related to bank performance and the factors analyzed.

Table 5. Driscoll and Kraay standard errors.

	Asset Growth			Income Growth		
Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
NPLs	−0.453 *** (0.102)	−0.398 *** (0.110)	−0.421 *** (0.107)	−0.315 *** (0.105)	−0.297 *** (0.112)	−0.301 *** (0.109)
Changes in inflation	−0.035 *** (0.012)	−0.033 *** (0.014)	−0.031 *** (0.013)	0.029 ** (0.013)	0.027 ** (0.012)	0.025 ** (0.014)
Bank size	0.071 *** (0.023)	0.069 *** (0.025)	0.072 *** (0.022)	0.065 *** (0.021)	0.062 *** (0.022)	0.064 *** (0.020)
ROA	0.101 *** (0.030)	0.098 *** (0.031)	0.095 *** (0.029)	0.089 *** (0.032)	0.087 *** (0.030)	0.084 *** (0.031)
CAR	0.150 *** (0.045)	0.143 *** (0.048)	0.139 *** (0.046)	0.130 *** (0.046)	0.127 *** (0.045)	0.121 *** (0.048)
NPLs × Bank's size		−0.015 ** (0.008)			−0.013 ** (0.008)	
NPLs × CAR			−0.029 ** (0.011)			−0.024 ** (0.011)
Constant	5.187 *** (1.213)	5.243 *** (1.200)	5.276 *** (1.209)	4.986 *** (1.165)	4.944 *** (1.179)	4.930 *** (1.152)
Number of observations	4301	4301	4301	4301	4301	4301
R-squared	0.483	0.476	0.470	0.454	0.448	0.442

*** $p < 0.01$, ** $p < 0.05$.

3.6. Dealing with Endogeneity Issue

The study identified a potential endogeneity problem between NPLs, inflation changes, bank size, ROA and CAR and the error term, which was addressed through several steps. First, income and asset growth were included as dynamic panel variables in the extended regression model to reduce endogeneity. Second, NPLs, inflation changes, bank size, ROA and CAR were lagged, and internal instrumental variables were used to further address the issue. Finally, external instrumental variables (e.g., investment, total assets, revenue) were incorporated to eliminate endogeneity.

After completing these steps, the Arellano-Bond (AR) tests confirmed the model's validity. The endogeneity concerns were effectively resolved, as evidenced by the statistically insignificant AR(2) test and the significant AR(1) test. The AR(2) results indicate no autocorrelation. The exogenous nature of the instrumental factors was established by the Sargan test, which yielded statistically insignificant results. The Hansen tests, which varied between 0.10 and 0.30, suggested no connection between the instrumental variables and the error term.

Table 6 confirms that the GMM results met the necessary specifications and were robust compared to the AMG and Driscoll-Kraay estimations. Despite differences in coefficient estimates and standard errors, the results' significance remained consistent. These findings validate the robustness of the GMM results after addressing endogeneity.

Table 6. Two-step GMM results.

Variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Dependent variables (−1)	−0.240 *** (0.011)	−0.283 *** (0.012)	−0.294 *** (0.011)	−0.040 *** (0.014)	−0.037 *** (0.014)	−0.045 *** (0.013)

Table 6. *Cont.*

Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
NPLs	−0.138 *** (0.008)	−0.400 *** (0.026)	−0.148 *** (0.007)	−0.120 *** (0.044)	−0.753 *** (0.302)	−0.763 *** (0.301)
Changes in inflation	−0.857 *** (0.068)	−0.109 *** (0.009)	−0.874 *** (0.065)	0.048 *** (0.012)	0.045 *** (0.011)	0.049 *** (0.012)
Bank size	0.247 ** (0.117)	0.269 *** (0.018)	0.278 *** (0.111)	0.119 *** (0.053)	0.543 *** (0.201)	0.683 *** (0.225)
ROA	0.534 *** (0.043)	0.524 *** (0.053)	0.573 *** (0.053)	0.294 *** (0.008)	0.292 *** (0.008)	0.302 *** (0.007)
CAR	0.072 *** (0.005)	0.071 *** (0.004)	0.076 *** (0.006)	0.174 *** (0.007)	0.178 *** (0.006)	0.183 *** (0.008)
NPLs × Bank's size		−0.587 *** (0.039)			−0.116 *** (0.048)	
NPLs × CAR			−0.834 *** (0.224)			−0.084 *** (0.011)
Number of observations	3795	3795	3795	3795	3795	3795
AR (1)	0.003	0.006	0.000	0.000	0.000	0.000
AR (2)	0.452	0.573	0.602	0.823	0.871	0.842
Sargan test	0.781	0.801	0.833	0.444	0.491	0.506
Hansen test	0.123	0.153	0.167	0.199	0.233	0.248

*** $p < 0.01$, ** $p < 0.05$.

4. Discussion of the Findings

4.1. The Effect of NPLs on Asset Growth

The study found that NPLs had a negative and significant impact on asset growth, supporting the hypothesis. This aligns with the RBV theory, which asserts that a company's competitive advantage and growth are shaped by its resources (Assensoh-Kodua, 2019). Higher NPL levels indicate reduced financial resources—vital assets for banks. Banks must reserve funds to cover loan losses rather than using these resources for expansion, limiting their growth potential. This result reinforces the RBV theory by showing that inadequate resource management, particularly regarding NPLs, hinders a bank's growth potential (Zheng et al., 2022).

These findings suggest that poor credit risk management, such as lending to high-risk borrowers, increases NPLs (Naili & Lahrichi, 2022). Such mismanagement not only stifles asset growth but also exacerbates financial instability. Economic downturns further limit borrowers' ability to repay loans, worsening NPL ratios and constraining asset and loan growth.

For investors, this situation results in diminished returns, as slowed asset and loan growth and the increasing costs of managing NPLs may lead to reduced shareholder value and profitability. This underscores the need for banks to implement robust credit risk management practices and prudent lending strategies. Addressing these issues will help reduce NPLs and foster more stable and profitable growth (Rachman et al., 2018).

The study also found that inflation had a negative and significant impact on asset growth, confirming the hypothesis. The RBV theory suggests that firms maintain a competitive advantage by managing their valuable resources effectively (Wang et al., 2018). Inflation erodes the real value of financial resources, diminishing the purchasing power of a bank's assets and restricting its growth potential (Agénor & da Silva, 2013). This economic pressure impairs the bank's ability to manage its resources efficiently, reinforcing the RBV theory.

The results highlight that inflation leads to increased operational costs, such as higher interest rates and rising prices for goods and services (Weber & Wasner, 2023). These pressures reduce the funds available for asset growth and limit capital for investments. Additionally, inflation weakens consumer demand for loans, further constraining banks' income and asset accumulation. Combined, these factors hinder banks' capacity to expand their assets.

Inflationary conditions also lead to lower investment returns, reducing profitability for investors. To maintain growth amidst rising inflation, banks must plan their financial resources carefully and implement strategies to mitigate inflation's impact (Stone, 2003). These strategies can help control operational expenses and maximize revenue streams.

The study revealed that bank size positively and significantly affected asset growth, supporting the hypothesis. The RBV theory suggests that larger banks can leverage their greater resources—such as human capital, technology, and funding—to promote growth (Donnellan & Rutledge, 2019). This finding supports the RBV theory, demonstrating that larger banks can utilize their resources more effectively to generate assets than smaller banks.

The positive impact of bank size on growth can be attributed to economies of scale, which allow larger institutions to reduce per-unit costs and improve resource allocation (Boot et al., 2002). Larger banks serve a wider customer base, have broader market access, and can diversify their asset holdings more effectively, leading to higher growth. Their market presence and cost management strategies contribute significantly to asset expansion (Gupta, 2009).

This result suggests that larger banks offer investors more reliable and potentially profitable growth opportunities, making them attractive investment options (Heffernan, 2005). For bank management, this underscores the importance of maintaining or expanding bank size to sustain or enhance asset growth and market competitiveness. Leveraging economies of scale can improve stability and long-term performance (Mauler et al., 2021).

ROA was found to have a positive and significant relationship with asset growth. According to the RBV, firms gain and sustain a competitive advantage by utilizing valuable, rare, inimitable, and non-substitutable internal resources (Sun et al., 2024). ROA reflects how effectively a bank uses its assets to generate profits, indicating the strength of its internal resources. A higher ROA signals operational efficiency, sound financial management, and optimal asset utilization—key intangible resources per the RBV (Kamasak, 2017). These findings validate that banks with superior internal capabilities experience greater asset growth through profit reinvestment and enhanced shareholder confidence.

Strong cost management, effective credit risk oversight, and strategic reinvestment allow banks to optimize the use of existing assets, contributing to growth (Brown & Moles, 2014; Choudhry, 2018). From an economic standpoint, a higher ROA signals operational efficiency and profitability, encouraging investors to allocate capital to high-performing banks. For management, this highlights the importance of maintaining superior asset quality and judiciously utilizing resources to drive further growth. These results emphasize the role of internal performance metrics in directing sustainable asset growth strategies and provide a framework for performance improvement and investment planning within the banking sector.

CAR was also found to positively and significantly influence asset growth. According to the RBV, CAR is a crucial internal financial resource that helps banks endure shocks, sustain operations during economic downturns, and pursue asset and revenue growth (Olawale, 2024). This result supports the RBV theory by showing that banks with substantial capital reserves have distinctive advantages that enable them to seize growth opportunities more aggressively.

The positive impact of CAR on asset growth can be attributed to increased confidence from regulators and investors in well-capitalized banks, which enhances access to capital and creates more investment and lending opportunities (Posner, 2015). Higher CAR signals increased expansion potential and reduced default risk, attracting investors seeking stability and long-term returns. For bank management, maintaining a strong CAR is critical for ensuring growth, meeting regulatory requirements, and strengthening competitive advantage. These findings underscore the importance of capital strength as a strategic asset that fosters growth and builds trust in the banking sector.

The study also revealed that the moderating effect of NPLs on bank size negatively and significantly impacted asset growth. According to the RBV, larger banks should have more resources to mitigate the risks associated with NPLs (Sannino et al., 2021). However, this finding suggests that even large banks struggle to leverage their size to reduce NPLs, indicating that the negative impact of bad loans outweighs the benefits of size. This contradicts the RBV theory, suggesting that size alone does not mitigate the adverse effects of NPLs on growth.

Operational inefficiencies in managing high NPLs may contribute to this outcome, even in large institutions (Zamore et al., 2023). These inefficiencies can increase costs and reduce the capacity for asset expansion. Additionally, regulations requiring larger banks to allocate substantial resources to capital reserves and provisions (Farag et al., 2013) may hinder their ability to grow and diversify asset portfolios.

This finding advises investors to be cautious when considering large banks with rising NPLs, as their size may not shield them from declines in asset growth (Kasinger et al., 2021). Effectively managing and reducing NPLs is essential for sustaining and promoting continuous asset growth, even in large banks. This highlights the importance of prioritizing NPL management strategies to enhance stability and performance.

Finally, the study found that the moderating effect of CAR on NPLs negatively and significantly affected asset growth. While CAR is a strategic internal resource, its association with high NPLs shifts focus from growth to risk management (Sadiq & Nosheen, 2021). This challenges the RBV, as banks' capital buffers are allocated to cover losses rather than expand assets.

Regulatory restrictions on well-capitalized banks, limiting aggressive asset expansion despite deteriorating credit quality (Kashyap et al., 2010; Avgouleas & Duoqi, 2017), may explain this result. For investors, this suggests that even well-capitalized banks may struggle with asset growth if burdened with substantial NPLs. Bank management must balance capital adequacy with proactive credit risk management, as relying solely on capital reserves without improving loan performance could undermine growth objectives. This emphasizes the critical role of asset quality and the nuanced impact of CAR in bank growth across different credit risk scenarios.

4.2. The Effect of NPLs on Income Growth

The study found that NPLs significantly and negatively impacted income growth. This highlights how poor asset quality rapidly undermines a bank's ability to generate stable income. According to the RBV, a bank's ability to generate income is a critical internal resource (Donnellan & Rutledge, 2019). Elevated NPL levels diminish this resource by reducing interest earnings, increasing provisioning expenses, and negatively affecting overall profitability. Thus, the findings support the RBV theory, demonstrating that deficiencies in internal resources, particularly operational assets, hinder financial performance and competitive advantage (Lubis, 2022).

The impact of elevated credit risk, diminished interest income from non-performing assets, and increased loan recovery and write-off expenses contributes to these results

(Chowdhury et al., 2017; Matenda et al., 2022). These challenges restrict a bank's capacity to reinvest in growth or innovation, signaling income volatility and diminished financial prospects in environments with high NPLs. It underscores the importance of bank executives adopting rigorous credit evaluation and lending regulation practices. Sustainable income growth requires enhancing loan performance, diversifying income streams, and maintaining strong risk management systems.

The investigation also revealed that inflation positively and significantly impacted income growth. The RBV suggests that firms achieve a competitive advantage by leveraging internal resources in response to external factors (Donnellan & Rutledge, 2019). Although inflation is typically seen as a macroeconomic threat, it can increase nominal interest rates and borrowing costs, generating interest income if banks adjust lending practices and manage expenses effectively (Ali et al., 2023). Banks' ability to capitalize on inflationary pressures to improve revenue aligns with the RBV.

When loan repricing outpaces rising expenses or deposit rate fluctuations, banks can benefit from increased interest margins during inflationary periods (Breyer et al., 2023), contributing to the positive impact. Inflation can also reduce the real burden of nominal loans, improve loan performance, and reduce defaults.

This outcome suggests that well-managed banks can use inflation to enhance profits. For managers, it emphasizes the need to implement dynamic pricing strategies, forecast inflation, and manage costs effectively. Aligning internal resources, such as interest rate management teams and adaptable lending policies, with inflationary trends will optimize revenue growth.

The study found that bank size positively and significantly impacted income growth. These findings support the RBV theory, which asserts that larger firms can leverage distinctive, valuable, and rare resources to achieve superior performance (Donnellan & Rutledge, 2019). Larger banks tend to have more diverse revenue streams, enhanced brand recognition, superior technology infrastructure, and larger customer bases, all of which contribute to increased income generation (Pramanik et al., 2019). This supports the RBV claim that size provides a strategic advantage.

The increased bargaining power, improved resource allocation efficiency, and economies of scale (Asongu & Odhiambo, 2019) observed in larger banks contributed to these positive outcomes. Over time, such banks may secure more affordable funding, expand product offerings, and enter more profitable sectors, leading to sustained income growth.

This finding holds economic significance for investors, suggesting that larger banks are likely to offer more stable returns due to their capacity to sustain income growth. It highlights the need for strategic scaling, mergers, and market expansion as growth strategies. Bank executives must invest in innovation and talent to maintain competitive advantages associated with scale, ensuring that growth translates to consistent income performance in both stable and volatile markets.

ROA was positively and significantly related to income growth, supporting the RBV theory, which emphasizes that internal resources and competencies are essential for success. ROA measures a bank's efficiency in utilizing assets to generate profits (Al Karim & Alam, 2013). A higher ROA indicates superior asset management, meaning the bank effectively uses its resources to enhance income generation.

Effective operational management, cost regulation, and strategic investment decisions enable banks to derive greater value from their assets, explaining the positive relationship. A strong ROA signals robust internal processes, optimized asset utilization, and increased profitability.

This suggests that banks with superior ROA may offer more attractive investment opportunities due to their operational efficiency and profitability. From a management

perspective, improving asset utilization through optimal strategies, better risk management, and resource allocation can further boost revenue. A higher ROA also signals financial health and long-term sustainability, attracting investment and supporting continued growth.

The study found that CAR positively and significantly influenced income growth. This aligns with the RBV theory, which stresses the importance of valuable, rare, and effectively managed internal resources for enhancing performance. A robust CAR enables a bank to withstand shocks, take risks, and maintain stable, profitable operations (Saadaoui & Mokdadi, 2023).

Well-capitalized banks can offer loans, invest in revenue-generating opportunities, and endure financial crises without compromising performance (Koch et al., 2016), which supports these results. Strong capital buffers also enhance investor and customer confidence, ensuring regulatory compliance and fostering increased corporate activity and revenue.

This finding suggests that enhancing operational resilience and making long-term strategic investments can elevate CAR levels, driving sustainable income growth. For investors, capital strength is a key determinant of income potential. For management, CAR should be seen as a strategic asset that enhances competitiveness and profitability, not merely a regulatory requirement. Maintaining a strong capital base is crucial for financial stability and income performance.

The study also revealed that the moderating relationship between NPLs and bank size negatively and significantly impacted income growth. These results challenge the RBV theory, which suggests that larger banks should better manage risks and sustain profits due to their greater resources. The study shows that as bank size increases, the negative effect of NPLs on income growth becomes more pronounced.

The complexity and bureaucracy of larger banks may lead to delayed responses to credit risks and inefficiencies in managing NPLs (Suárez & Sánchez Serrano, 2018), explaining this outcome. Large banks may be more vulnerable to risky lending portfolios across multiple markets, exacerbating the negative impact of NPLs on income when poorly managed.

This result suggests to investors that size alone may not protect income growth from increasing NPLs, and risk management strategies should adapt to a bank's growth. Bank management must ensure that size growth leads to income stability rather than increased risk, by strengthening internal controls, streamlining decision-making processes, and implementing more flexible credit risk management systems.

The study also found that the moderating relationship between NPLs and CAR negatively and significantly impacted income growth. These results challenge traditional RBV assumptions. While a higher CAR is typically seen as a resource that allows banks to withstand loan losses and maintain income stability, the data indicate that elevated CAR levels exacerbate the negative impact of NPLs on income growth.

This outcome may occur when banks with high CAR adopt overly conservative lending practices following an increase in NPLs, resulting in reduced interest income and weakened financial performance (Suárez & Sánchez Serrano, 2018). Insufficient allocation of surplus capital to profitable loan opportunities could also signal inefficiencies.

Economically, this outcome indicates that merely maintaining high capital levels is insufficient for ensuring income growth, particularly in the face of rising NPLs. Investors in high-CAR banks may question the quality of profits and capital allocation strategies. The findings highlight the need for banks to balance capital adequacy with proactive income-generating strategies and risk-adjusted lending policies, ensuring profitability despite deteriorating loan quality.

5. Materials and Methods

5.1. Sample and Data

The United States was chosen as the focus of this study due to its comprehensive and well-established regulatory framework, including key legislation such as the Dodd-Frank Act, which promotes financial stability and resilience within the banking sector (Feehan, 2020). Its rigorous banking protocols, combined with complex market dynamics—characterized by diverse financial products and intense competition—make the U.S. an ideal setting for examining the impact of NPLs on bank performance.

Analyzing how NPLs affect the operational and financial strategies of U.S. banks is critical for understanding growth patterns both domestically and globally. The structural diversity of U.S. banks—varying in size, market position, and financial strength—offers a robust platform for investigating how different institutions respond to rising NPL levels (Tarchouna et al., 2022). This diversity supports a nuanced analysis of the relationship between NPLs and bank growth across various institutional contexts.

Thomson Reuters Eikon DataStream was selected as the primary data source due to its reliability and access to comprehensive financial datasets. It provides the historical data necessary for rigorous academic analysis. The study focused on banks listed on the New York Stock Exchange that maintained complete and consistent financial records from 2007 to 2023 and operated continuously within the United States, ensuring data reliability and comparability. Non-banking financial institutions such as insurance companies, hedge funds, and investment firms were excluded due to their distinct business models and regulatory frameworks, while banks that were delisted, merged, or lacked sufficient disclosures during the period were also removed to avoid missing data and bias.

A purposive sampling technique was employed, yielding a final sample of 253 banks that met the inclusion criteria. Balanced panel data were used instead of unbalanced data to enhance consistency and reduce bias, providing a more accurate and representative overview of bank performance throughout the study period.

This study selected the period 2007–2023 due to its coverage of major transformations in the U.S. banking sector, beginning with the global financial crisis and Lehman Brothers' collapse in 2008, followed by significant regulatory reforms (Dodd-Frank, Basel III), and extending through the COVID-19 shock (2020) and the recent banking turmoil of 2023. This span captures crisis, recovery, and new challenges, making it ideal for this study.

5.2. Dependent and Independent Variables

Table 7 presents the details of the variables, including their operationalization.

Table 7. Summary of variables.

Index	Variable	Abbreviation	Formulae
	Dependent variables:		
1	Asset growth rate	ASGT	$\left(\frac{Assets_t - Assets_{t-1}}{Assets_{t-1}}\right) * 100$
2	Income growth rate	IEGT	$\left(\frac{Income_t - Income_{t-1}}{Income_{t-1}}\right) * 100$
	Independent variables:		
1	Non-performing loans	NPLs	$\left(\frac{Non-performing\ loans}{Total\ loans}\right) * 100$
	Control variable:		
1	Changes in inflation	CGIF	$\left(\frac{Inflation_t - Inflation_{t-1}}{Inflation_{t-1}}\right) * 100$
2	Bank's size	BASZ	Log (total assets)
3	Return on assets	ROA	$\left(\frac{Net\ income}{Average\ total\ assets}\right) * 100$
4	Capital Adequacy Ratio	CAR	$\left(\frac{\text{Tier 1 Capital+Tier 2 Capital}}{Risk-Weighted\ Assets}\right) * 100$

5.2.1. Dependent Variables

The study employed two dependent variables to measure bank growth: asset growth and income growth. Asset growth refers to the annual increase in a bank's total assets over a given period (Juárez, 2018). This measure reflects the bank's capacity to expand its asset base, indicating operational efficiency and financial strength. It also signals the institution's ability to grow through acquisitions, investments, or increased deposits (Dagher et al., 2016). As such, asset growth serves as a key indicator of a bank's development and its ability to leverage resources for sustained expansion and stability.

Income growth, also measured annually, captures the increase in a bank's total revenue, including both interest income and non-interest sources such as fees and commissions (Hunjra et al., 2020; Mensah et al., 2025). It reflects the bank's financial performance and its ability to generate returns from core operations. A steady rise in income suggests strong market presence, operational efficiency, and sound financial management (Jain, 2024). In this study, income growth was calculated as the annual percentage change in total income, serving as a direct measure of financial expansion and revenue-generating capacity.

5.2.2. Independent Variable

The study identified NPLs as the independent variable due to their significant influence on bank growth and expansion. High levels of NPLs negatively affect a bank's capacity to grow by increasing loan loss provisions, reducing profitability, and constraining financial resources (Mileris, 2015; Ugoani, 2016). They also impede investment decisions, weaken risk management capabilities, and undermine investor confidence. By selecting NPLs as the independent variable, the study aims to assess their impact on banks' growth trajectories, operational scalability, and overall financial stability (Arhinful et al., 2025b).

5.2.3. Control Variables

This study examined the effects of four control variables—inflation, bank size, return on assets (ROA), and CAR—on bank growth. Controlling for inflation is essential to ensure that observed changes in income and asset growth are not solely driven by shifts in purchasing power (Moridu et al., 2022). Inflation, measured by the annual percentage change in the Consumer Price Index (CPI), influences bank profitability, loan interest rates, and borrowers' ability to repay. Including inflation in the model captures relevant macroeconomic effects that could otherwise distort the relationship between NPLs and bank growth (Ahmed et al., 2021).

Bank size significantly affects access to capital, risk diversification, and economies of scale (Brighi & Venturelli, 2014). Larger banks often have greater resilience to loan defaults and may grow differently than smaller institutions (M. C. Chang et al., 2011). Bank size was measured using the natural logarithm of total assets. Controlling for size ensures that differences in growth outcomes are not merely a result of institutional scale, allowing a more accurate evaluation of NPLs' impact on growth (Aledeimat & Bein, 2025).

ROA measures a bank's efficiency in using its assets to generate profits (Arhinful & Radmehr, 2023a). It was calculated as net income divided by average total assets. Higher ROA indicates stronger financial performance and a greater capacity for growth. Controlling for ROA accounts for profitability variations that could influence how banks manage NPLs and pursue expansion strategies (Nisar et al., 2018).

Finally, the CAR, a key indicator of a bank's solvency and ability to absorb losses, was included as a control variable (Oino, 2021). Measured as the ratio of Tier 1 and Tier 2 capital to risk-weighted assets, CAR reflects a bank's financial resilience. Including CAR ensures that the impact of NPLs on bank growth is not confounded by differences in capitalization levels (Olawale, 2024).

5.3. The Choice of Estimation Methods

The first step in selecting the appropriate estimation methods for this study was to conduct a cross-sectional test to assess whether the panel data exhibited cross-sectional dependence. To determine whether to accept the alternative hypothesis of cross-sectional dependence over the null hypothesis of cross-sectional independence, we performed the Friedman, Frees, and Pesaran tests. The results in Table 8 indicate the presence of cross-sectional dependence, suggesting that unobserved variables may simultaneously influence the growth of multiple banks.

Table 8. Cross sectional, heterogeneity and endogeneity test.

Types of CD Tests	Asset Growth	Income Growth
Pesaran's test	16.062 (0.000) ***	28.284 (0.000) ***
Friedman's test	773.057 (0.000) ***	937.413 (0.000) ***
Frees' test	0.426 (0.000) ***	0.495 (0.000) ***
Heterogeneity test (Peseran-Yamagata test)		
Δ-tilde stat.	3.255 (0.000) ***	11.234 (0.000) ***
Δadj-tilde stat.	6.237 (0.000) ***	23.453 (0.000) ***
Endogeneity tests		
Durbin-Wu-Hausman (DWH) Test	12.345 (0.000) ***	33.453 (0.000) ***
Wu-Hausman test	18.532 (0.000) ***	66.723 (0.000) ***

*** $p < 0.01$.

The second step involved assessing the heterogeneity of the panel dataset using the Pesaran-Yamagata tests. This test helped evaluate the diversity within the dataset, with the null hypothesis indicating heterogeneity and the alternative hypothesis suggesting homogeneity. As shown in Table 8, the data's heterogeneity implies that different banks respond to NPLs in distinct ways.

Given both the heterogeneity of the data and the presence of cross-sectional dependence, it was crucial to choose an advanced estimation technique that could produce robust and unbiased results. The Feasible Generalized Least Squares (FGLS) method was selected due to its ability to address these issues effectively. Unlike Fixed Effects (FE) models, which may fail to capture cross-sectional correlations, FGLS incorporates a correction mechanism for correlations across cross-sections in the panel data (Sunge & Ngepah, 2022). This adjustment helps mitigate the impact of these correlations, leading to more accurate estimates. When cross-sectional dependence is present, Random Effects (RE) models, assuming uncorrelated observations, may generate skewed estimates (Arhinful et al., 2023a). Similarly, Ordinary Least Squares (OLS) may yield unreliable predictions under such conditions. Therefore, FGLS was deemed the most suitable model for this study, as it provides more precise and unbiased results while accounting for interdependencies. The general form of the FGLS estimator is:

$$\hat{\beta}FGLS = \left(X^{!}\Omega^{-1}X\right)^{-1}X^{!}\Omega^{-1}Y^{-1}$$

$\hat{\beta}FGLS$ is the vector of estimated coefficients.
X is the matrix of independent variables.
Y is the vector of the dependent variable.
$X^{!}$ is denotes the transpose of matrix.
Ω is the covariance matrix of the error terms, which may involve heteroscedasticity or autocorrelation. In FGLS, Ω is estimated, making the procedure feasible.

The final step in selecting the appropriate estimation method was to assess whether the independent variables were endogenous or exogenous. This distinction is critical, as endogeneity can lead to biased results if not properly addressed. We evaluated this using the

Wu-Hausman and Durbin-Wu-Hausman (DWH) tests. The alternative hypothesis indicated the presence of endogeneity, while the null hypothesis suggested that the independent variables were exogenous. The results in Table 8 confirmed endogeneity, suggesting a correlation between NPLs, inflation changes, bank size, ROA, CAR, and the error term.

Endogeneity implies that unobserved factors or reverse causality may influence both bank growth and NPLs. To address this, the Generalized Method of Moments (GMM) was selected. GMM provides consistent, unbiased estimates by using instrumental variables that are uncorrelated with the error term (Arhinful & Radmehr, 2023b). Applying GMM in this study minimized bias and provided a more accurate understanding of the relationship between bank growth and NPLs. The GMM model is expressed as:

$$\theta^{GMM} = argmin\theta\left\{\left(\frac{1}{N}\sum_{i-1}^{N} g(yi, xi, Zi)\right) W \left(\frac{1}{N}\sum_{i-1}^{N} g(yi, xi, Zi)\right)\right\}$$

where:

$\hat{\theta}$ GMM is the Two-Step GMM estimator of the parameter vector.
W is a weighting matrix that optimizes the efficiency of the estimator.

5.4. Model Specification

The study employed three models to examine the impact of NPLs on bank growth, each designed to offer a distinct perspective on this relationship. Model 1 analyzes the direct impact of NPLs on bank growth. Model 2 explores how bank size moderates this relationship. Model 3 investigates the moderating role of the CAR in the relationship between NPLs and bank growth.

Model 1:

$$(ASGT\ or\ IEGT) = \beta 0_{n,\,B} + \beta 1 NPLs_{n,\,B} + \beta 2 CGIF_{n,\,B} + Log\beta 3 BASZ_{n,\,B} + \beta 4 ROA_{n,\,B} + \beta 5 CAR_{n,\,B} + u_{n,\,B} \quad (1)$$

Model 2:

$$(ASGT\ or\ IEGT) = \beta 0_{n,\,B} + \beta 1 NPLs_{n,\,B} + \beta 2 CGIF_{n,\,B} + Log\beta 3 BASZ_{n,\,B} + \beta 4 ROA_{n,\,B} + \beta 5 CAR_{n,\,B} + \beta 6 NPLs * LogBASZ_{n,\,B} + u_{n,\,B} \quad (2)$$

Model 3:

$$(ASGT\ or\ IEGT) = \beta 0_{n,\,B} + \beta 1 NPLs_{n,\,B} + \beta 2 CGIF_{n,\,B} + Log\beta 3 BASZ_{n,\,B} + \beta 4 ROA_{n,\,B} + \beta 5 CAR_{n,\,B} + \beta 6 NPLs * CAR_{n,\,B} + u_{n,\,B} \quad (3)$$

NB: The definition of the abbreviation is provided in Table 7. The years of the data were denoted by "n", the banks were denoted by "B", and the error term was denoted by "U".

6. Conclusions

NPLs play a critical role in bank growth. When a significant portion of a bank's loan portfolio becomes non-performing, its ability to pursue development opportunities and increase lending is severely restricted. NPLs tie up funds that could otherwise be invested in profitable ventures. This study aimed to examine the impact of NPLs on bank growth.

The research used purposive sampling to select 253 banks listed on the New York Stock Exchange from 2007 to 2023 that met the inclusion criteria. To address cross-sectional dependence and endogeneity issues in the data, advanced FGLS and GMM estimation methods were applied.

The study found that NPLs had a negative and significant impact on both asset and income growth. Changes in inflation were found to negatively affect asset growth while positively influencing income growth. Additionally, the study revealed that bank

size negatively moderated the relationship between NPLs and growth for both asset and income growth.

7. Managerial Implications

Banks listed on the New York Stock Exchange should prioritize key strategies to optimize asset and loan growth, starting with strengthening credit risk management. This involves enhancing loan approval processes and utilizing advanced analytics to assess borrower risks more accurately. Improved credit assessments can reduce non-performing loans, fostering stable asset and loan growth.

Another critical strategy is leveraging the bank's size to improve operational efficiency. Banks should use their size to streamline expansion projects, simplify processes, and reduce costs through technology and automation. Optimizing existing platforms and expanding digital services will enhance client engagement and drive loan growth.

Banks must also adapt their lending policies to prevailing economic conditions, particularly inflation. Regularly adjusting lending terms and interest rates ensures competitiveness and attracts borrowers. A flexible pricing approach enables banks to capitalize on growth opportunities while maintaining loan portfolio profitability.

Lastly, large banks must effectively manage NPLs while balancing growth efforts. A comprehensive strategy that aligns expansion goals with strong recovery and collection initiatives is crucial for sustainable development. Periodic assessments of risk management strategies will reinforce this balance and contribute to long-term economic success.

8. Limitation of the Study

The study's primary limitation was the lack of complete data for some banks. Although the Thomson Reuters Eikon DataStream lists more banks than the 253 included in this study, some banks ceased operations before 2023, while others were established after 2007, resulting in incomplete data for the study period. As a result, these banks were excluded, leaving a final sample of 253.

Another limitation is the inability to compare the findings with prior studies, as the research explores a gap in the literature that has not previously been examined. While earlier studies have considered NPLs, bank growth, or CAR individually, few have integrated these factors within a single framework, particularly for U.S. banks. This uniqueness enhances the contribution of the study by offering new insights but also restricts the possibility of benchmarking the results directly against existing research.

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